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(71) Applicant(s)
Nissan Motor Company Limited

(Incorporated in Japan)

2 Takara-cho, Kanagawa-ku, Yokohama-shi, Kanagawa-ken 211, Japan

(72) Inventor(s)
Tetsuya Asada

(74) Agent and/or Address for Service
Marks & Clerk
57-60 Lincoln's Inn Fields, LONDON, WC2A 3LS, United Kingdom

(54) Door lock system for vehicles

(57) A vehicle door lock system employs an internal manually operated means 1 and an externally actuable motor 16 to operate a door locking/unlocking mechanism 10. A super locking arrangement allows motor 17 to act on a member 8 to decouple the means 1 from the mechanism 10. When the ignition switch is operated and the door is locked and superlocked, a control arrangement causes an unlocking signal to be repeated until unlocking action is detected.

As shown, on detection of ignition action the unlocking signal is sent to motors 16 and 17 until a switch 12 linked to unlock action signals unlocking. When unlocking occurs the member 8 is brought into contact with a member 21 to disable the super locking. In another embodiment (figs 8,9) when ignition action is detected a signal is sent to motor 17 until a switch actuable by member 8 signals the disabling of the super locking.

FIG.5

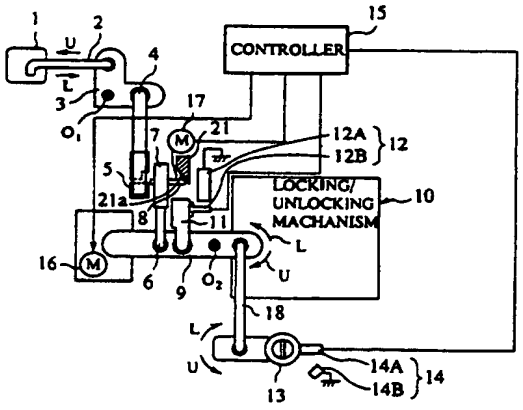

FIG.7

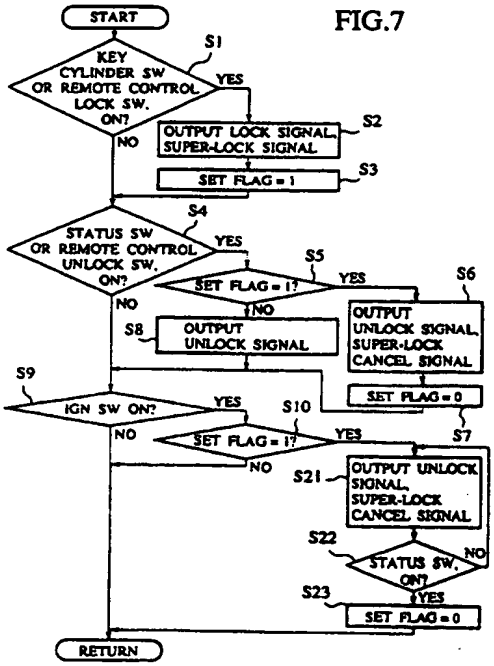

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FIG.1

PRIOR ART

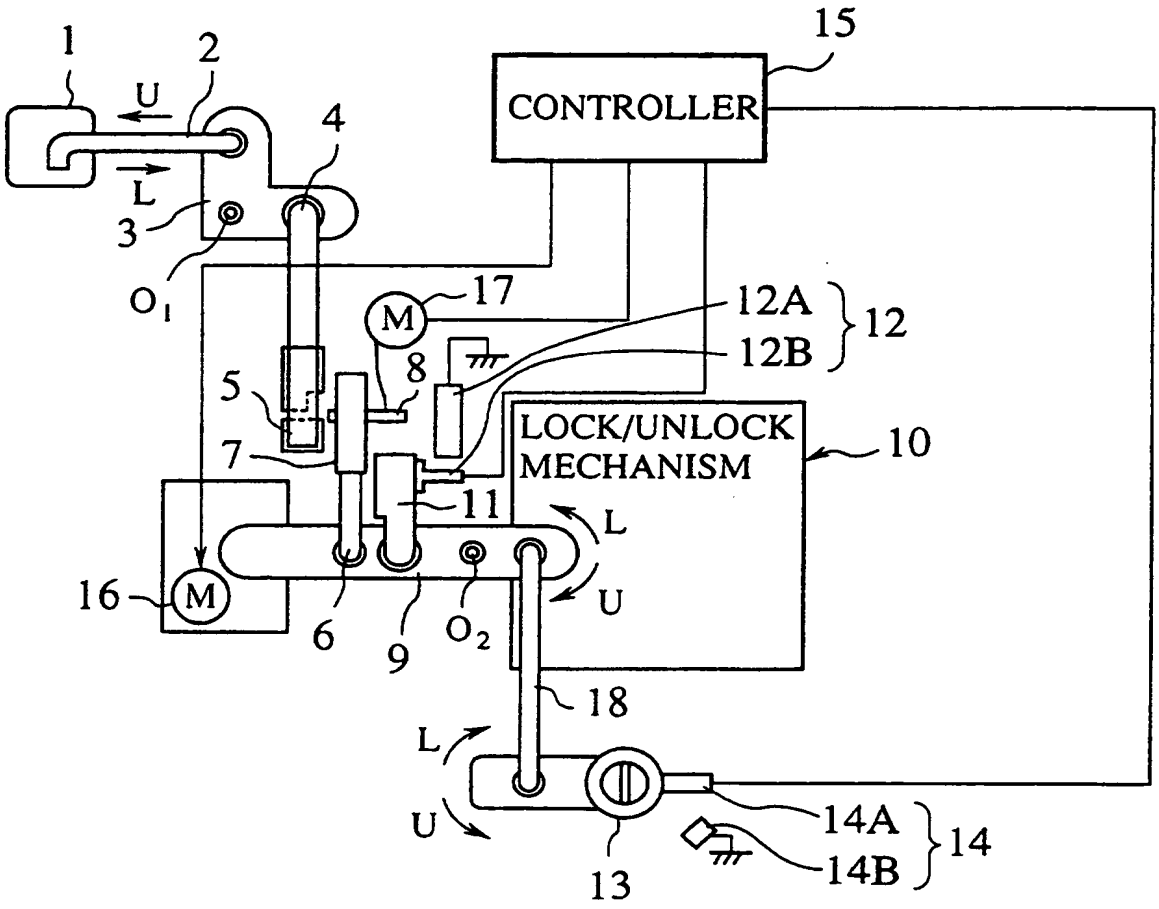


FIG.2
PRIOR ART

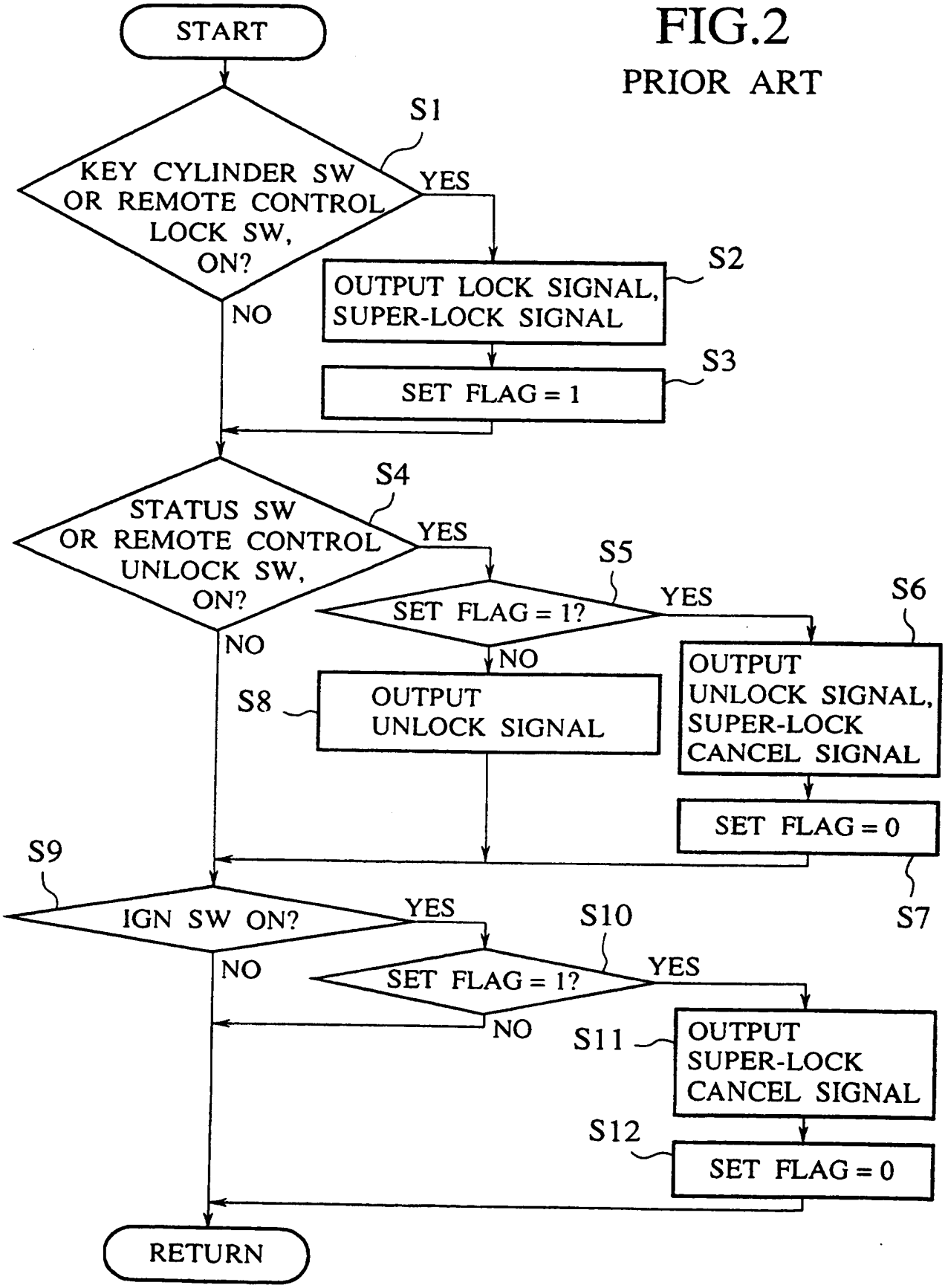


FIG.3

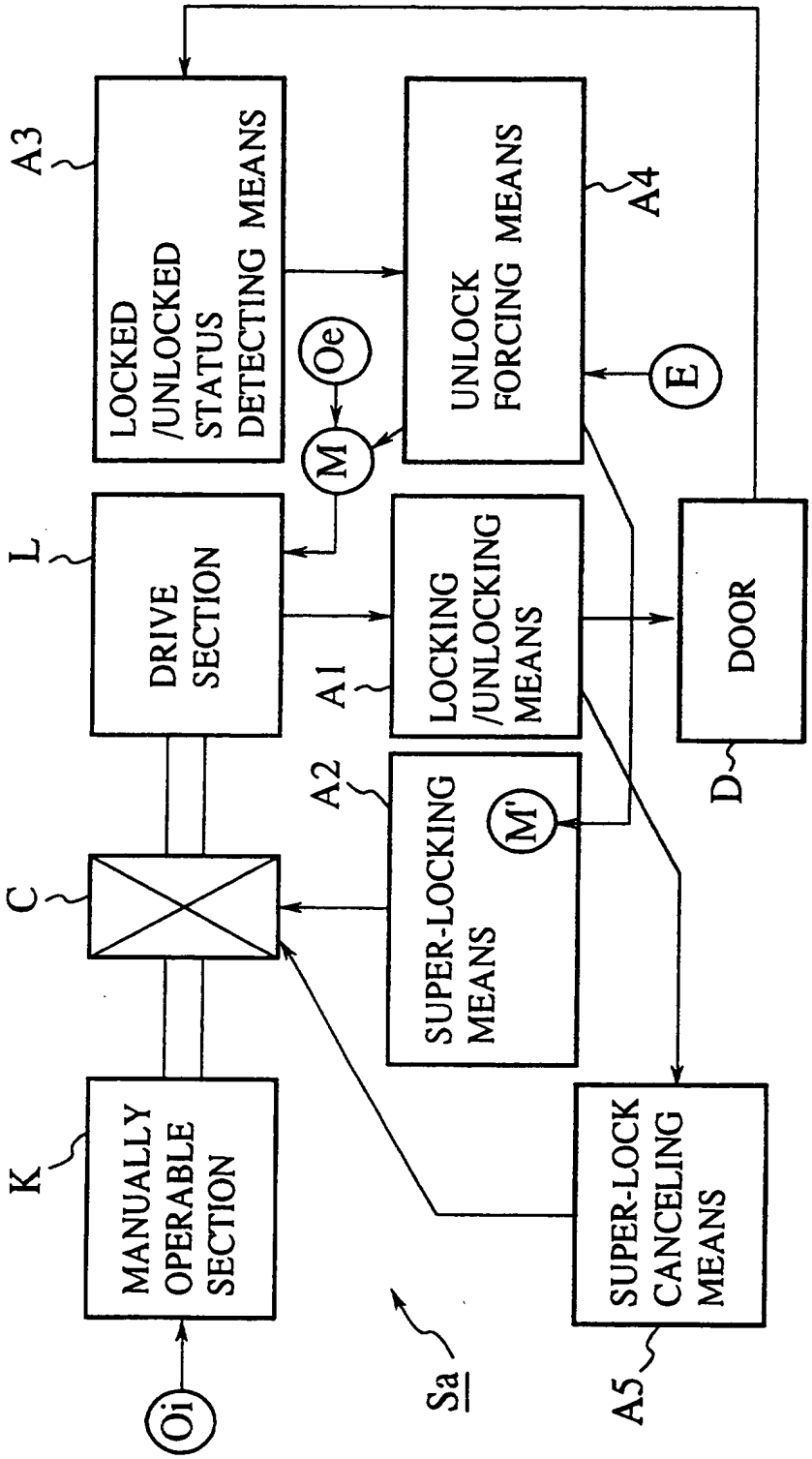

A3
LOCKED /UNLOCKED STATUS DETECTING MEANS
A4
UNLOCK FORCING MEANS
Oe
M
E
L
DRIVE SECTION
A1
LOCKING /UNLOCKING MEANS
DOOR
D
A2
SUPER-LOCKING MEANS
M'
C
K
MANUALLY OPERABLE SECTION
Oi
Sa
SUPER-LOCK CANCELING MEANS
A5

FIG.4

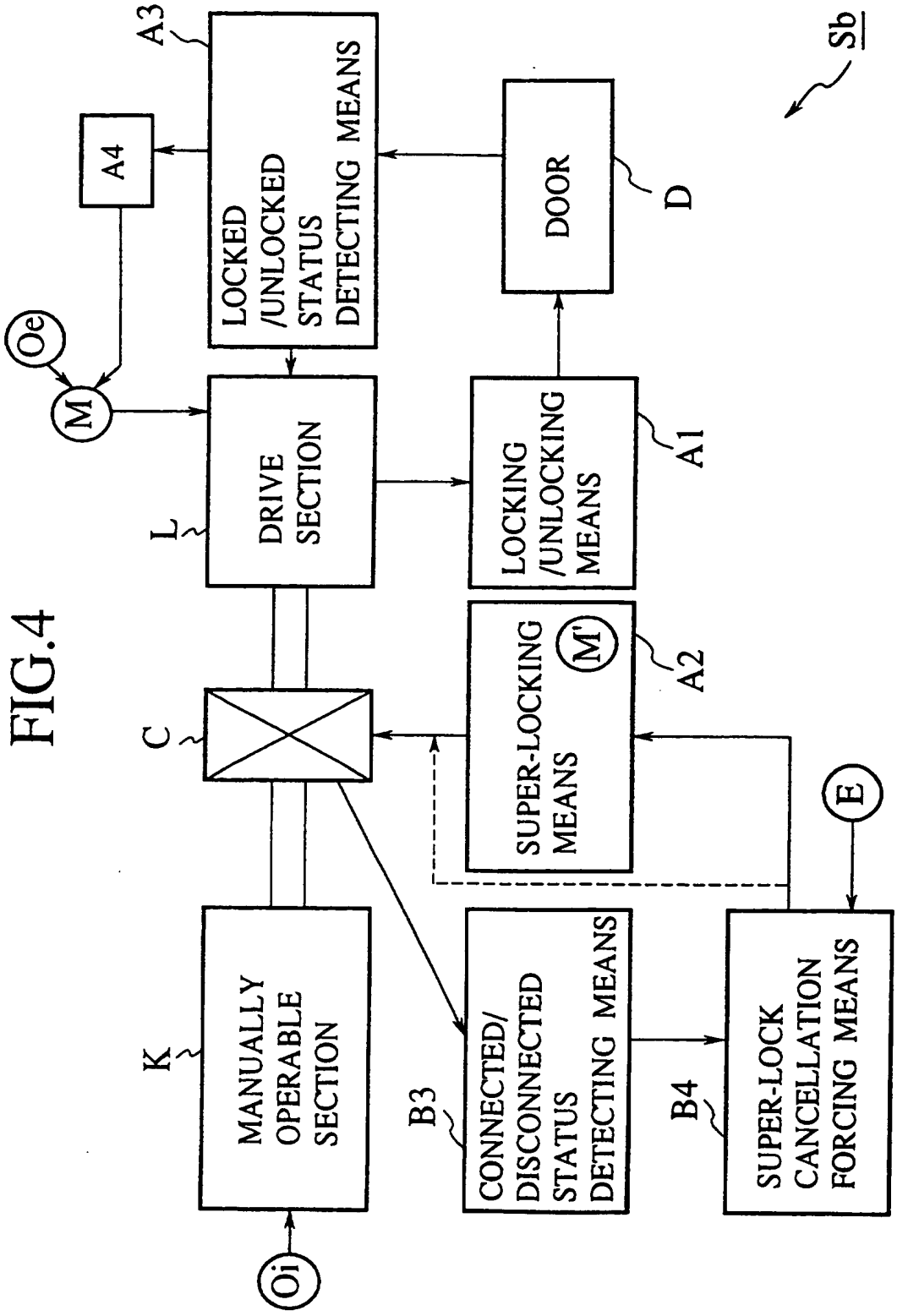

Sb
A3
LOCKED /UNLOCKED STATUS DETECTING MEANS
A4
DOOR
D
Oe
M
L
DRIVE SECTION
LOCKING /UNLOCKING MEANS
A1
SUPER-LOCKING MEANS
M'
A2
C
E
K
MANUALLY OPERABLE SECTION
B3
CONNECTED/ DISCONNECTED STATUS DETECTING MEANS
B4
SUPER-LOCK CANCELLATION FORCING MEANS
Oi

FIG.5

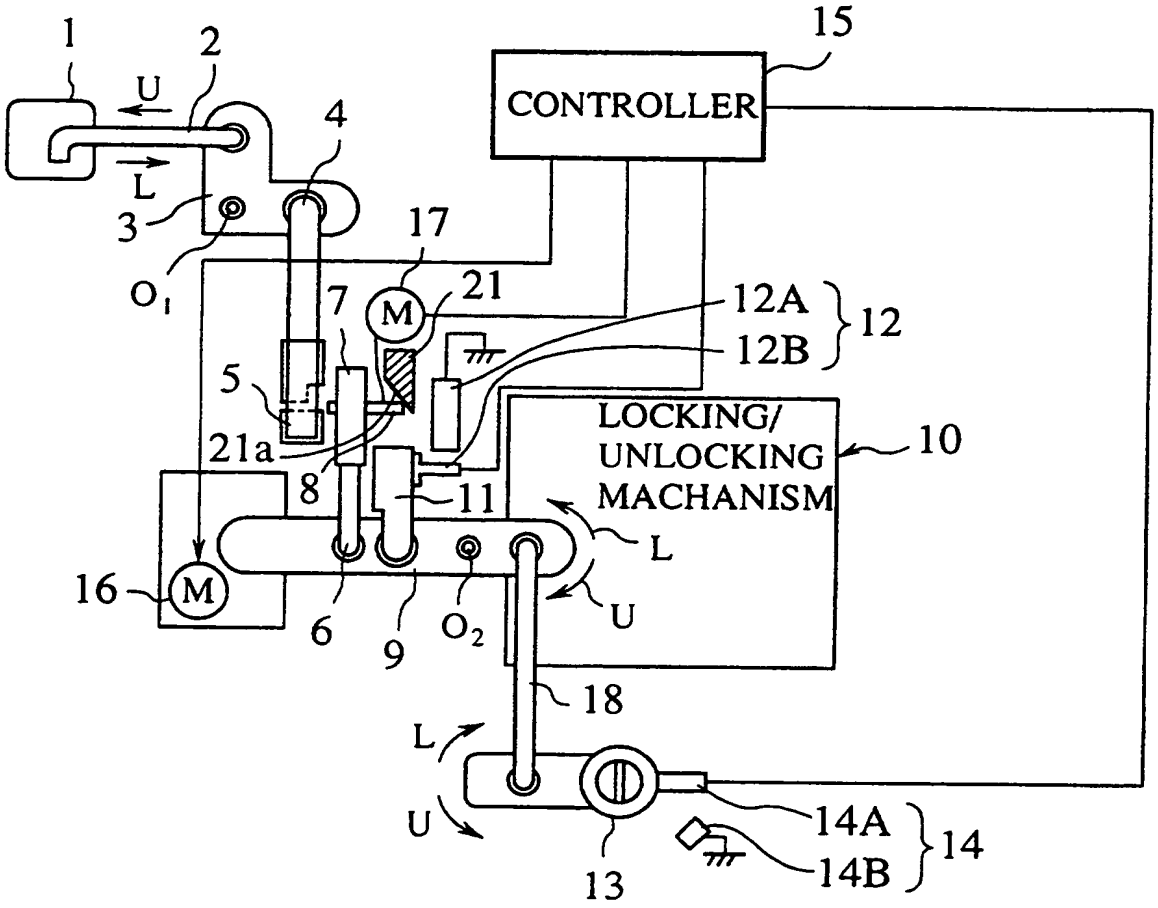

1
2
U
L
3
4
O_1
17
7
M
21
12A
12B
12
5
21a
8
11
LOCKING/
UNLOCKING
MACHANISM
10
L
U
16
M
6
9
O_2
18
L
U
13
14A
14B
14
CONTROLLER
15

FIG.6

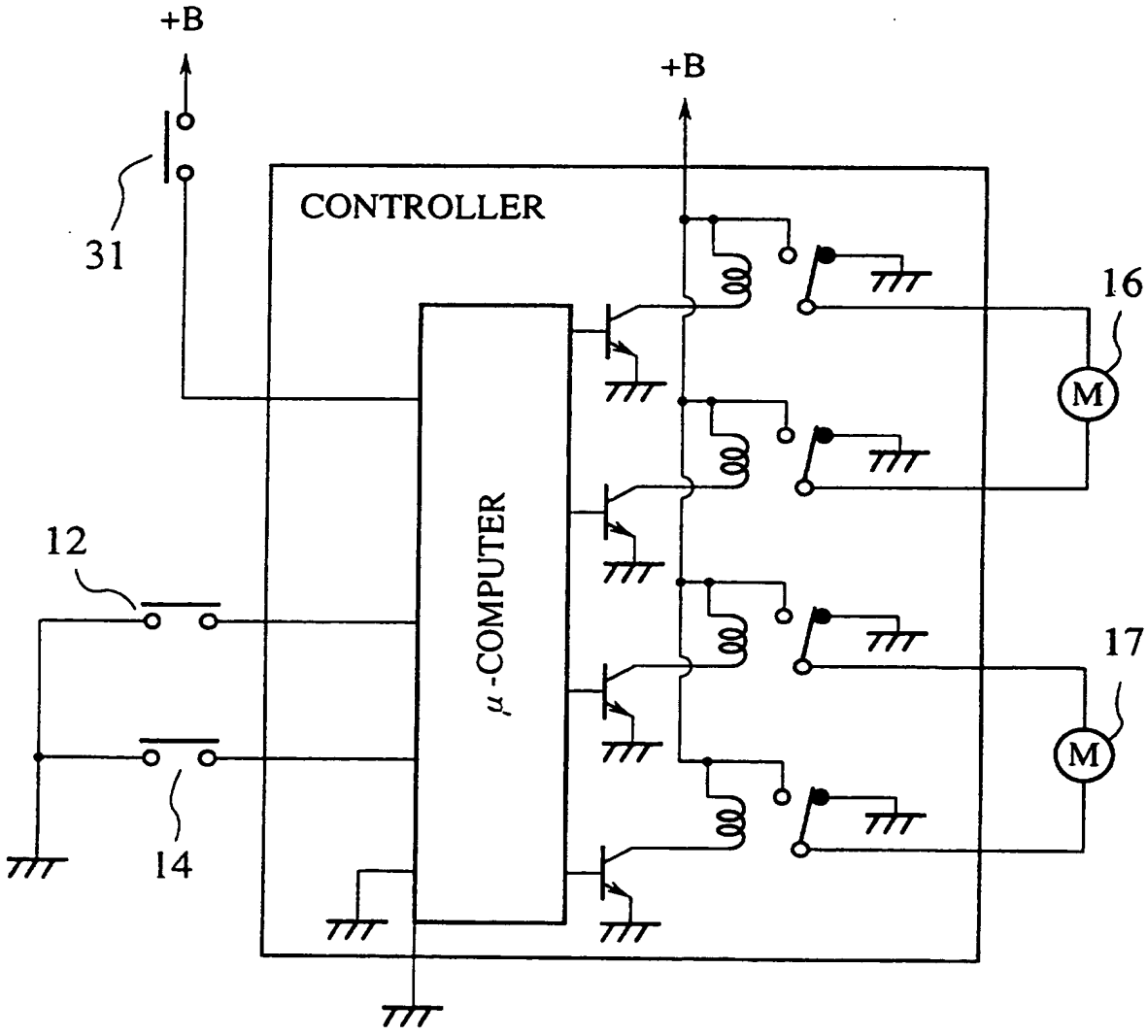


FIG.7

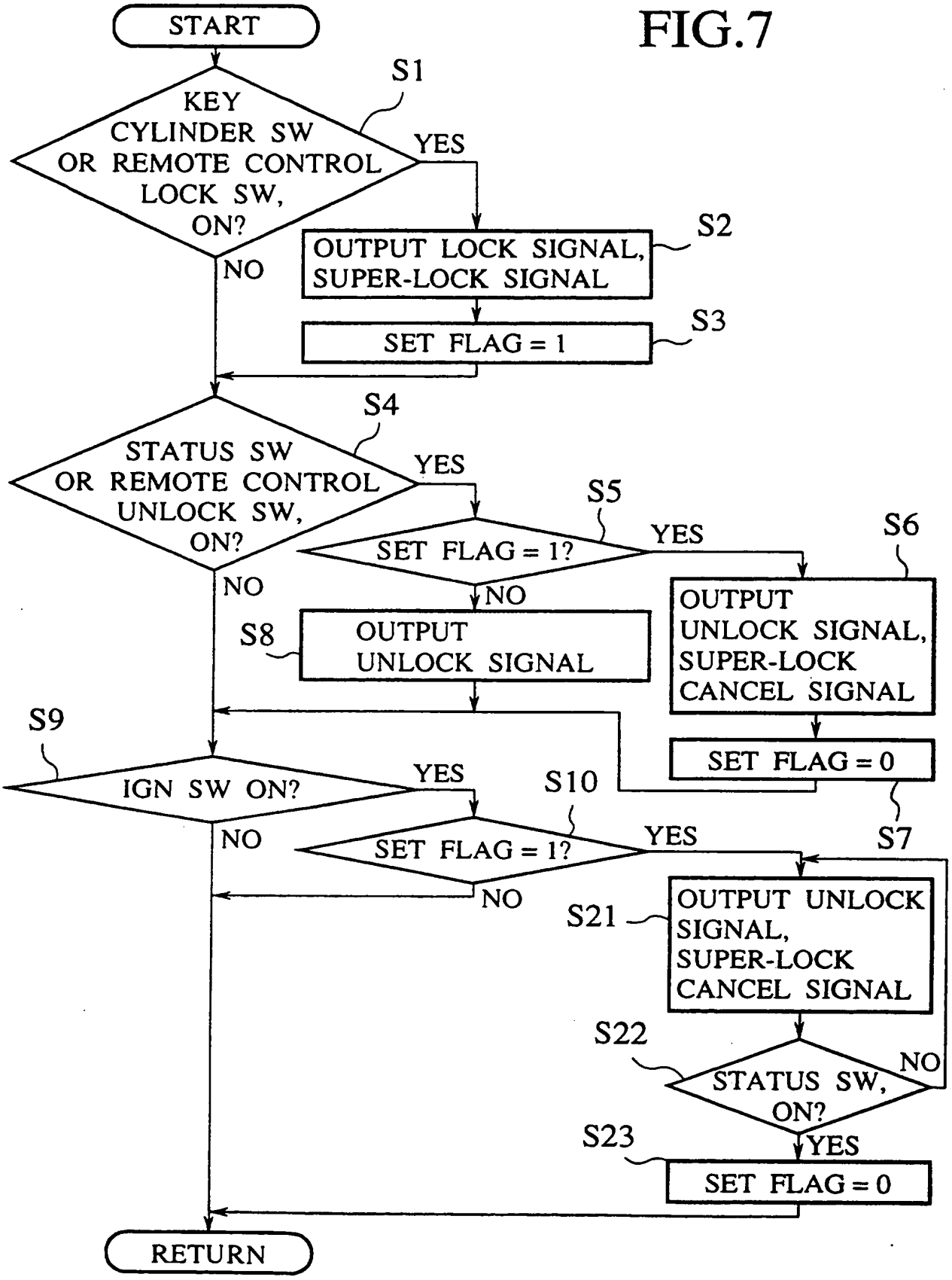

START
S1
KEY CYLINDER SW OR REMOTE CONTROL LOCK SW, ON?
YES
NO
S2
OUTPUT LOCK SIGNAL, SUPER-LOCK SIGNAL
S3
SET FLAG = 1
S4
STATUS SW OR REMOTE CONTROL UNLOCK SW, ON?
YES
NO
S5
SET FLAG = 1?
YES
NO
S6
OUTPUT UNLOCK SIGNAL, SUPER-LOCK CANCEL SIGNAL
S8
OUTPUT UNLOCK SIGNAL
SET FLAG = 0
S7
S9
IGN SW ON?
YES
NO
S10
SET FLAG = 1?
YES
NO
S21
OUTPUT UNLOCK SIGNAL, SUPER-LOCK CANCEL SIGNAL
S22
STATUS SW, ON?
NO
YES
S23
SET FLAG = 0
RETURN

FIG.8

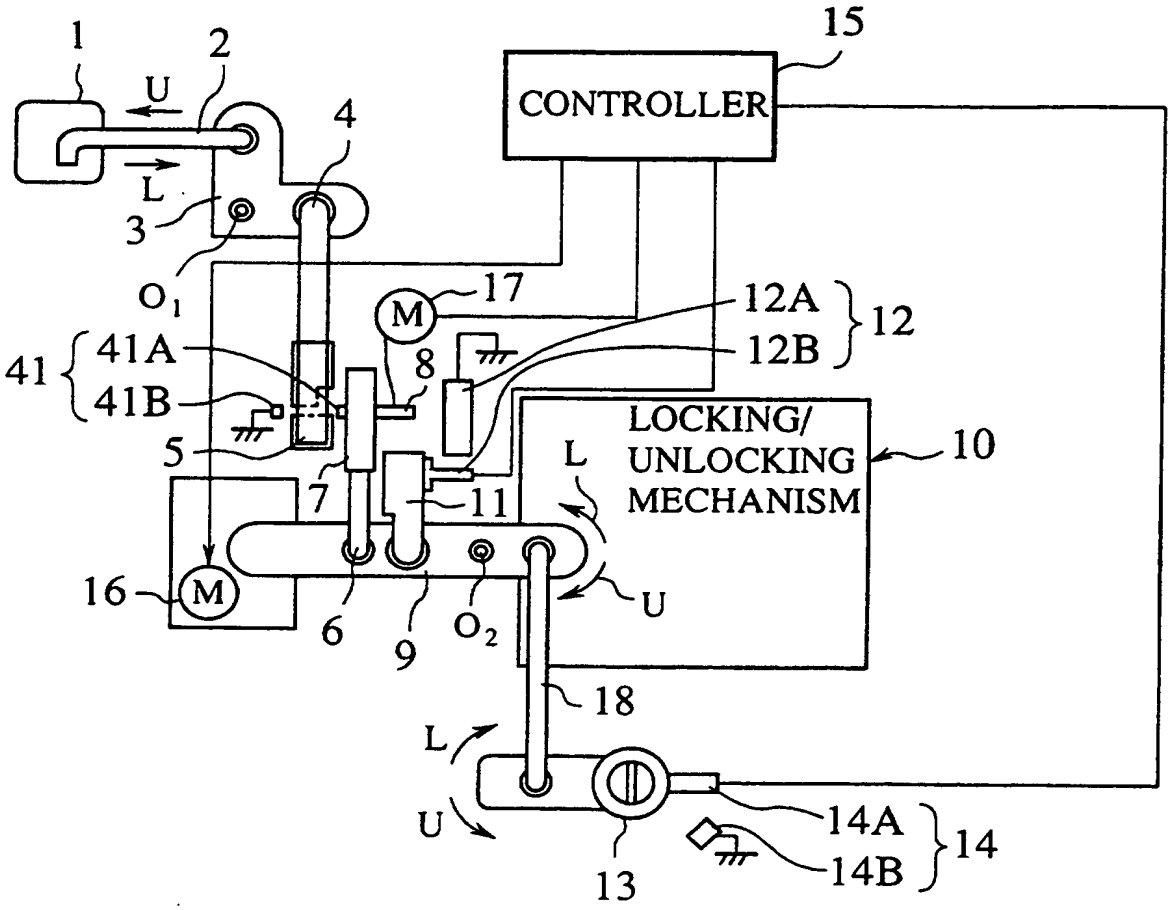
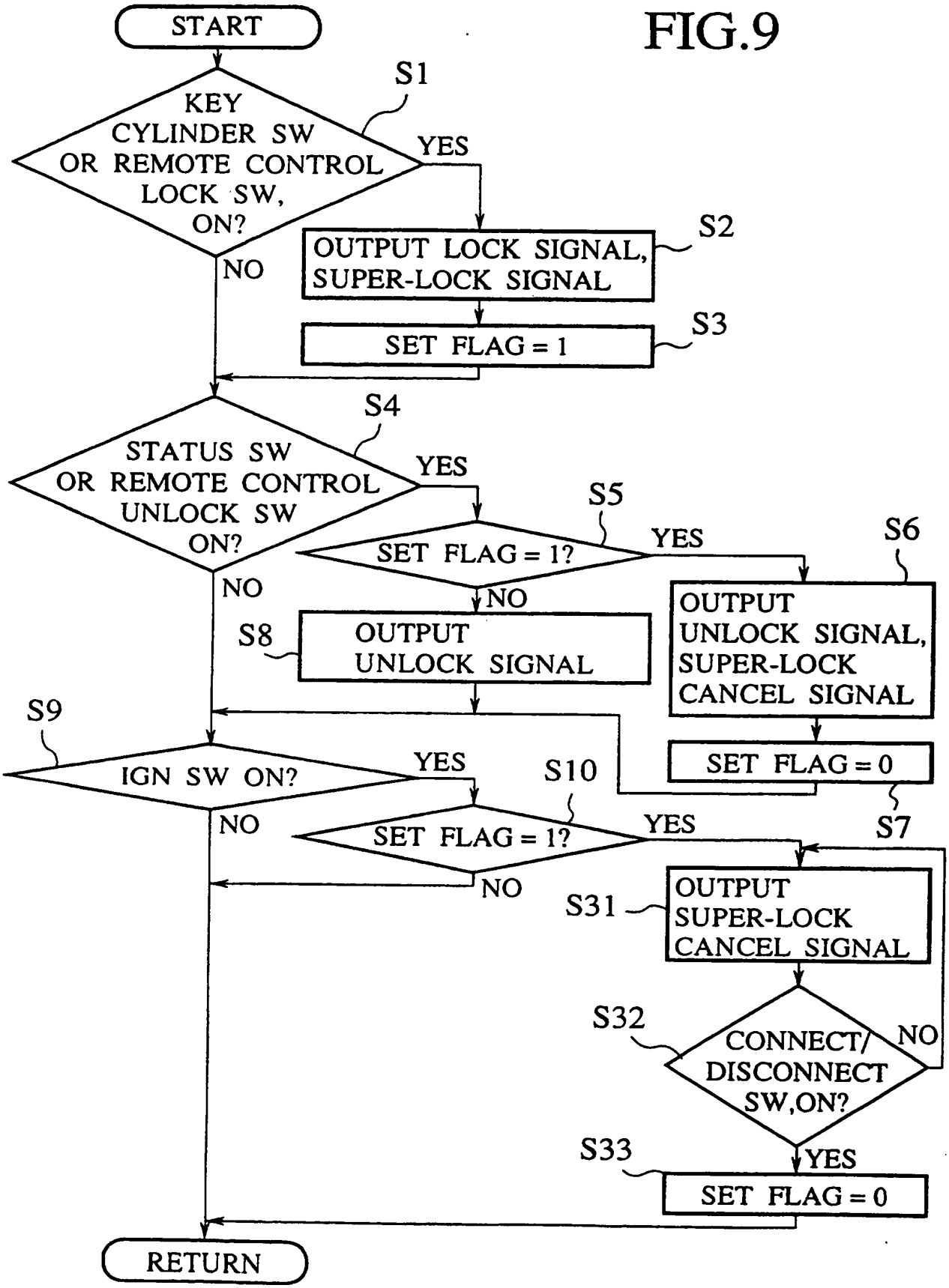

1
2
U
L
3
4
15
CONTROLLER
O_1
M
17
12A
12B
12
41
41A
41B
8
5
7
11
LOCKING/
UNLOCKING
MECHANISM
10
L
U
16
M
6
9
O_2
18
L
U
13
14A
14B
14

FIG.9


START
S1
KEY CYLINDER SW OR REMOTE CONTROL LOCK SW, ON?
YES
NO
S2
OUTPUT LOCK SIGNAL, SUPER-LOCK SIGNAL
S3
SET FLAG = 1
S4
STATUS SW OR REMOTE CONTROL UNLOCK SW ON?
YES
NO
S5
SET FLAG = 1?
YES
NO
S6
OUTPUT UNLOCK SIGNAL, SUPER-LOCK CANCEL SIGNAL
S8
OUTPUT UNLOCK SIGNAL
SET FLAG = 0
S7
S9
IGN SW ON?
YES
NO
S10
SET FLAG = 1?
YES
NO
S31
OUTPUT SUPER-LOCK CANCEL SIGNAL
S32
CONNECT/ DISCONNECT SW,ON?
NO
YES
S33
SET FLAG = 0
RETURN

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DOOR LOCK SYSTEM FOR VEHICLES

The present invention generally relates to a door lock system for vehicles, and particularly, it relates to a door lock system adapted for locking and unlocking a door of a vehicle and provided with a super-locking subsystem for disabling the door to be manually unlocked by a door locking and unlocking knob (hereafter "door lock knob") disposed in a passenger room, thereby to effect theft prevention of the vehicle.

Fig. 1 is a block diagram of a concerned part of a conventional door lock system including a super-locking mechanism, and Fig. 2, a flow chart of a control program associated with the concerned part of the door lock system of Fig. 1.

In Fig. 1, designated at reference character 1 is a door lock knob disposed on an interior side of a respective one of doors provided for a passenger room of a vehicle. The door lock knob 1 is operable in both locking (hereafter sometimes simply "L") and unlocking (hereafter sometimes simply "U") directions thereof. As the knob 1 is operated in the L or U direction, a knob rod 2 moves in an L or U direction thereof, i.e. rightwardly or leftwardly in Fig. 1, causing a bell crank 3 to rotate about a fulcrum O_1 clockwise (hereafter sometimes "CW") or counterclockwise (hereafter sometimes "CCW"), so that a linked knob rod 4 goes down or goes up.

The knob rod 4 serves as an upper knob rod member to be coupled with a lower knob rod member 6. The upper and lower knob rod members 4, 6 have rods 5, 7 fixed thereto as a pair of coupling members connectable to each other by a coupling pin 8. The coupling pin 8 and rods 5, 7 constitute an essential portion of the super-locking mechanism at the respective door.

The door lock system is controllable into a "super-lock on" state of the doors, where it has at each door the coupling pin 8 actuated in a shown right position in Fig. 1 allowing for super-locking of the door, as well as into a "super-lock off" state of the doors, where the pin 8 returns to a left position to cancel the super-locking.

Normally, the super-lock off state is selected. As the pin 8 is located in the left position, the coupling members 5, 7 are interconnected with each other to effect a coupling between the upper and lower knob rod members 4, 6. As the upper rod member 4 is displaced downwardly or upwardly with the door lock knob 1 operated in the L or U direction, the lower rod member 6 follows the movement, causing a lever 9 to rotate CCW or CW about a fulcrum O_2 thereof, actuating a locking and unlocking mechanism (hereafter sometimes "L/U mechanism") 10 to lock or unlock the door, respectively. As the rotation of lever 9 is CCW or CW, a linked lever 11 moves downwardly or upwardly, causing a pair of contact elements 12A, 12B of an L/U status detecting switch 12 to be separated from or contacted to each other so that the status switch 12 turns off or on, respectively.

In the super-lock on state, the coupling pin 8 is displaced in the right position, so that the upper and lower rod members 4, 6 are disconnected from each other, failing to transmit any operation of the door lock knob 1 to the L/U mechanism 10. As a result, the door lock system is unable to be responsible for knob operations to lock or unlock any door.

The respective door has a key lock cylinder (hereafter simply "key cylinder") 13 operable from outside the vehicle with an unshown key. It is permitted for a person standing outside the vehicle to lock and unlock the doors by rotating the key cylinder 13 with the key inserted therein. As the key cylinder 13 is rotated CW or CCW, an associated switch (hereafter "key cylinder switch") 14 has a pair of contact elements 14A, 14B thereof contacted to or separated

from each other so that the key cylinder switch 14 turns on or off, outputting a corresponding signal to a door lock system controller 15, where it is processed to output a corresponding control signal to an electromotive door lock actuator 16, which is responsive thereto to rotate the lever 9 CCW or CW, causing the L/U mechanism 10 to lock or unlock the door.

If this rotation of lever 9 is CW in the super-lock off state, the linked lever 11 moves upwardly, turning the status switch 12 on, outputting a corresponding signal to the controller 15, where it is processed to output a corresponding control signal to a super-locking actuator 17, which is responsive thereto for forcing the coupling pin 8 to move rightwardly for disengagement from the coupling member 5, so that the door lock system is kept from responding to operations of the door lock knob 1 to lock or unlock any door.

The key cylinder 13 is linked via a key cylinder rod 18 to the lever 9, so that at one door in which the key cylinder 13 is manually rotated with the inserted key, the lever 9 is rotated in dependence thereon through the rod 18, causing the L/U mechanism 10 to concurrently lock or unlock the door, while the other doors are locked or unlocked with their electromotive door lock actuators 16 working as described.

It is known to employ a remote controller for transmitting an operation signal such as an infrared beam to a receiver, such as a light receiving element installed in a window glass, to drive a door lock actuator 16 for electromotive locking or unlocking and/or a super-lock actuator 17 for super-locking or cancellation thereof.

There will be described actions of the conventional door lock system with reference to Fig. 2. The description will be limited to a concerned door for clarity, unless otherwise explained.

It is now assumed that a driver having finished driving has come out of the vehicle and inserted the key to

the key cylinder 13. As the inserted key is turned in its locking direction, the key cylinder switch 14 turns on and an interlinked motion of the lever 9 actuates the L/U mechanism 10 to lock the door. In use of a remote controller, a remote control lock switch is operated to effect locking of the door, and a remote control signal is transmitted to be received at the vehicle end. In either case, a corresponding signal is input to the system controller 15, where it is processed by a control program repeating a control cycle.

At a step S1 of the cycle, the program exercises a decision as to whether or not the key cylinder switch 14 or the remote control lock switch is turned on. As a switch-on status is confirmed by the input signal, the program flow goes to a step S2. Unless it is confirmed, the flow goes to another decision step S4.

At the step S2, the program instructs the controller 15 to output a lock signal to a respective remaining door (and the concerned door in the case of remote control) and a super-lock signal to each door of the vehicle.

The lock signal is input to the door lock actuator 16 of the respective door, which is responsive thereto to rotate CCW the lever 9 associated therewith, actuating the L/U mechanism 10 to lock the door. The status switch 12 outputs an L detection signal.

The super-lock signal is input to the super-lock actuator 17, causing the coupling pin 8 to move in the right position for super-locking at each door.

The flow then goes to a step S3 for setting a "super-lock on" flag to a 1, before it goes to the decision step S4.

It is now assumed that the driver has come back to the vehicle for subsequent driving and inserted the key to the key cylinder 13. As the inserted key is turned in its unlocking direction, the key cylinder switch 14 turns off and an interlinked motion of the lever 9 actuates the L/U mechanism 10 to unlock the door. In use of the remote

controller, a remote control unlock switch is operated to effect unlocking of the door, and a remote control signal is transmitted to be received at the vehicle end. In either case, a corresponding signal is input to the system controller 15. The L detection signal from the status switch 12 remains on.

At the step S4, a decision is made as to whether the L detection signal from the status switch 11 is on or not or the remote control unlock switch is on or not. As an on status is confirmed by the input signal, the program flow goes to a subsequent decision step S5. Unless it is confirmed, the flow goes to another decision step S9.

At the step S5, it is checked if the super-lock on flag is set to the 1.

As the door lock operation has been performed after the previous driving, the door lock system should have been in the super-lock on state and the flag should be the 1. Accordingly, the flow goes to a step S6.

At the step S6, the controller 15 outputs an unlock signal to the respective remaining door (and the concerned door in the case of remote control) and a super-lock cancel signal to each door of the vehicle.

The unlock signal is input to the door lock actuator 16 of the respective door, which is responsive thereto to rotate CW the lever 9 associated therewith, actuating the L/U mechanism 10 to unlock the door. The status switch 12 outputs a U detection signal.

The super-lock cancel signal is input to the super-lock actuator 17, causing the coupling pin 8 to move in the left position, where it is inserted in the coupling member 5 so that the upper and lower rod members 4, 6 are interlocked with each other by the coupling members 5, 7. As a result, the door lock system is put in the super-lock off state, permitting each door to be locked or unlocked by operation of the door lock knob 1.

The flow then goes to a step S7 for resetting the super-lock on flag to a 0, before it goes to the decision

step S9.

Incidentally, such as when going out of the vehicle for a short while, the driver may give an L operation to the door lock knob 1 to simply close the door, without using the key for the lock operation to effect super-locking. In such a case, the door lock system is left in the super-lock off state. As the flag is not set to the 1 at the step S5, the program flow goes therefrom to the step S9, via a mediate step S8 for merely outputting the unlock signal to the door lock actuator 16 of the respective remaining door (and of the concerned door in the case of remote control).

At the step S9, it is checked if an ignition switch of the vehicle is turned on (by a driver sitting on a driver's seat). Unless it is turned on, the program flow enters a returning routine. If it is turned on, the flow goes to a subsequent decision step S10 to again check if the flag is set to the 1. If the flag = 1, the flow goes to a step S11. Unless the flag = 1, the flow goes to the returning routine.

In a typical case, the door lock system should then have been set in the super-lock off state by an unlock operation exercised along with an entry into the passenger room, and hence the flag should have been reset to the 0. Therefore, the flow goes from the step S10 to the returning routine.

In an occasional case, however, the remote controller may have been put in a pocket by the driver or left in hand of someone standing outside and unintentionally operated for the lock operation to effect a super-locking, or the key cylinder switch 14 may have been short-circuited, outputting a switch-on state. Then, as the flag is set to the 1, the flow goes to the step S11.

At the step S11, the super-lock cancel signal is output to the super-lock actuator 17 of each door to cancel the super-locking, thus permitting the door to be unlocked by the door lock knob 1. Then, the flow goes to a step

S12 for resetting the flag to the 0, before entering the returning routine.

In the conventional door lock system described, the step S11 is simply followed by the step S12.

The step S9 checks for an ignition switch turned on (probably to start a travel), when the step S10 finds a super-lock on state of the door lock system in which each door lock knob 1 is non-responsive to L/U operations. This state is found by checking if the flag be set to the 1. In this situation, the step S11 is called for cancelling the super-lock on state. However, no consideration is provided to check if the cancellation of super-lock on state is effected, before the step S12 where the flag is reset to the 0.

The ignition is for cranking to start an engine using electric power from a vehicle-mounted battery, of which a supply voltage may be reduced. The super-lock actuator 17 receives a load that may become too large to ensure a sufficient coupling between the upper and lower rod members 4, 6.

In such occasional events, some person in the passenger room has to stretch the arm through an opened window outside the vehicle, insert the key into the key cylinder 14 and give a manual unlock operation, before opening the door to go outside. Such the operation may not be always easy.

In this concern, the step S11 might have included a concurrent or substitute step of controlling the door lock actuator 16 to effect unlocking, if the actuator 16 were rigid enough to withstand an increased load.

The present invention has been achieved with such points in mind.

It would be desirable to be able to provide a door lock system for vehicles permitting ensured unlocking or super-lock cancellation after

engine startup, allowing a person to go out of the vehicle without undue operations.

It would also be desirable to be able to provide a door lock system for vehicles permitting ensured super-lock cancellation to be interlocked with unlocking.

As illustrated in Fig. 3 for visual comprehension, a first aspect of the invention provides a door lock system Sa for a vehicle having an engine E and a passenger room provided with a door D, the door lock system Sa including a manually operable section K for transmitting an internal operation Oi manually exercised inside the passenger room, a drive section L connectable (at a point C) to and disconnectable from the manually operable section K, an electric actuator M controllable for actuating the drive section L in accordance with an external operation Oe exercised outside the vehicle, locking/unlocking means A1 as a first means drivable by the drive section L for locking and unlocking the door D in accordance with one Oi/Oe of the internal operation Oi, as the drive section L is connected to the manually operable section K, and the external operation Oe, as the drive section L is actuated by the electric actuator M, and super-locking means A2 as a second means controllable for disconnecting the drive section L from the manually operable section K to render the internal operation Oi ineffective, wherein the door lock system Sa further includes locked/unlocked status detecting means A3 as a third means for detecting to confirm a locked status of the door D and an unlocked status of the door D, and unlock forcing means A4 as a fourth means operable along with a startup operation of the engine E, as the locked status is confirmed by the locked/unlocked status detecting means A3, for controlling the electric actuator M so that the locking/unlocking means A1 is driven (or forced) to unlock the door D until the locked status is confirmed by the locked/unlocked status detecting means A3.

According to the first aspect, as super-locking to a door D by a super-locking means A2 is cancelled and hence a drive section L that may be a link lever is connected to a manually operable section K that may be a door lock knob, it is permitted for an internal operation Oi exercised in a passenger room to actuate the drive section L to thereby lock or unlock the door D.

It also is permitted for an external operation Oe exercised such as by a key or a remote controller outside the vehicle to control an electric actuator M so as to lock or unlock the door D.

Such a locked or unlocked status of the door D is detected to be confirmed by a locked/unlocked status detecting means A3. The confirmation may comprise outputting a detection signal to a door lock system controller, and/or checking the signal or a corresponding flag in the controller.

Then, a driver enters the passenger room, sits on a driver's seat and gives a startup operation to an engine E that may include turning on an ignition switch by the key.

The door D may then be in an occasional locked status for some reason.

According to the first aspect, however, as this locked status is confirmed by the locked/unlocked status detecting means A3, an unlock forcing means A4 is operable along with the startup operation of the engine E, for controlling the electric actuator M to actuate the drive section L so that the locking/unlocking means A1 is driven to repeat an action for unlocking the door D, until a locked status will be detected and confirmed by the locked/unlocked status detecting means A3.

Therefore, even in a case the electric actuator M has temporarily reduced power for actuation due such as to a battery voltage drop when cranking, the actuator M is kept controlled continuously or intermittently for actuating the drive section L to unlock the door D, over a sufficient interval for a battery to supply a recovered voltage so

that the actuator M has necessary power for the door M to be unlocked.

The driver as well as other passengers, if any, can go out of the vehicle without conventional drawbacks such as an undue key operation with an arm stretched through an open window.

According to a second aspect of the invention, as it depends from the first aspect, the unlock forcing means A4 is operable along with said controlling the electric actuator M, until the unlocked status is confirmed by the locked/unlocked status detecting means A3, for cancelling a super-locking action of the super-locking means A2 to connect the drive section L with the manually operable section K so that the locking/unlocking means A1 is drivable in accordance with the internal operation Oi.

According to the second aspect, in addition to controlling the actuator M for unlocking the door D as in the first aspect, the unlock forcing means A4 functions before a confirmed unlocking, for cancelling a super-locking action (e.g. a disconnecting action) of the super-locking means A2 so that a cancelled super-lock on state permits an effective manual operation Oi for locking or unlocking the door D. The super-lock cancellation may comprise stopping and/or reverse rotating a later-described super-locking actuator M'.

According to a third aspect of the invention, as it depends from the first or the second aspect, the door lock system Sa further includes super-lock cancelling means A5 as a fifth means mechanically interlocked with an unlocking action of the locking/unlocking means A1, for connecting the drive section L with the manually operable section K.

According to the third aspect, the door lock system Sa is permitted to have a super-locking cancellation mechanically interlocked with a door unlocking action so that a super-lock off state can be achieved even when the electric actuator M or the like is disordered.

According to a fourth aspect of the invention, as it

depends from the third aspect the locked/unlocked status detecting means A3 confirms the unlocked status, as it is detected after a confirmation of the locked status, by having a (detection) signal output at a timing past a connection between the drive section L and the manually operable section K.

According to the fourth aspect, a time lag between from detection of unlocked status to confirmation thereof permits ensured cancellation of a super-lock on state, as a super-lock off state is established with an established connection between the drive section L and the manually operable section K.

According to a fifth aspect of the invention, as it depends from any of the first to the fourth aspect, the super-locking means A2 has an electric actuator M' controllable for cancelling a connected state of the drive section L with the manually operable section K to render the manual operation Oi ineffective.

According to the fifth aspect, a door lock system controller is permitted to control an electric actuator M' for super-locking in a programmed manner.

Further as illustrated in Fig. 4 for visual comprehension, a sixth aspect of the invention provides a door lock system Sb for a vehicle having an engine E and a passenger room provided with a door D, the door lock system Sb including a manually operable section K for transmitting an internal operation Oi manually exercised inside the passenger room, a drive section L connectable (at a point C) to and disconnectable from the manually operable section K, an electric actuator M controllable for actuating the drive section K in accordance with an external operation Oe exercised outside the vehicle, locking/unlocking means A1 as a first means drivable by the drive section K for locking and unlocking the door D in accordance with one Oi/Oe of the internal operation Oi, as the drive section L is connected to the manually operable section K, and the external operation Oe,

as the drive section L is actuated by the electric actuator M, and super-locking means A2 as a second means controllable for disconnecting the drive section L from the manually operable section K to effect a super-locking for rendering the internal operation Oi ineffective, wherein the door lock system Sb further includes connected/disconnected status detecting means B3 as a third means for detecting a connected status and a disconnected status of the drive section L relative to the manually operable section K, and super-lock cancellation forcing means B4 as a fourth means operable along with a startup operation of the engine E, as the disconnected status is detected by the connected/disconnected status detecting means B4, for cancelling (or for a forced cancellation of) the super-locking until the connected status is detected by the connected/disconnected status detecting means B3.

According to the sixth aspect, along with a startup operation of an engine E such as by turning an ignition switch on, if the door lock system Sb be in a super-lock on state for some reason, as an associated disconnection between a drive section L and a manually operable section K is detected by a connected/disconnected detection means B3, it is permitted for a super-lock cancellation forcing means B4 to be continuously or intermittently operated for a (forced) cancellation of the super-locking, e.g. by directly or indirectly (via an actuator M' of a super-locking means A2) acting on a coupler C between the drive section L and the manually operable section K, to have an established connection therebetween, until this connection will be detected by the connected/disconnected status detecting means B3.

Therefore, the system Sb is reset to a super-lock off state, permitting a door D to be locked or unlocked in accordance with a familiarized manual operation Oi exercised in a passenger room of a vehicle, even in an emergent case.

The driver as well as other passengers, if any, can go

out of the vehicle without conventional drawbacks such as an undue key operation with an arm stretched through an open window.

This system Sb may also comprise a combination of a locked/unlocked status detecting means A3 and an unlock forcing means A4.

It will be seen that the systems Sa and Sb have their system controllers such as a microcomputer, and the respective means A1 to A5 and B3, B4 may each comprise either or both of hardware and software

The above and further objects and novel features of the present invention will more fully appear from the following detailed description when the same is read in conjunction with the accompanying drawings, in which:

Fig. 1 is a block diagram of a concerned part of a conventional door lock system including a super-locking mechanism;

Fig. 2 is a flow chart of a control program associated with the concerned part of the door lock system of Fig. 1;

Fig. 3 is an illustrative block diagram for visual comprehension of a door lock system according to a first aspect of the invention;

Fig. 4 is an illustrative block diagram for visual comprehension of a door lock system according to another aspect of the invention;

Fig. 5 is a block diagram of a part associated with a concerned door of a door lock system according to an embodiment of the invention;

Fig. 6 is an electrical connection diagram of a concerned part of a controller of the door lock system of Fig. 5;

Fig. 7 is a flow chart of a control program associated with the part in concern of the door lock system of Fig. 5;

Fig. 8 is a block diagram of a part associated with a concerned door of a door lock system according to another

embodiment of the invention; and

Fig. 9 is a flow chart of a control program associated with the part in concern of the door lock system of Fig. 8.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

There will be described below the embodiments of the present invention with reference to the accompanying drawings. Like members are designated by like reference characters, omitting redundancy.

Figs. 5-7 show an embodiment of the invention covering the first to the fifth aspect Sa. Fig. 5 is a block diagram corresponding to Fig. 1, and Fig. 7, a flow chart corresponding to Fig. 2.

In a door lock system shown in Fig. 5, members or parts 1 to 17 are identical to those of Fig. 1, unless otherwise described herein.

The door lock system of Fig. 5 includes a locking/unlocking means A1 comprising an L/U mechanism 10, and a super-lock cancelling means A5 mechanically interlocked with a U action of the L/U mechanism 10 that may be associated with a U operation at a key cylinder 13.

The super-lock cancelling means A5 comprises an engagement member 21 fixed in position so that its tapered surface 21a engages with a right end of a coupling pin 8 carried by a right coupling rod 7, as a lower rod member 6 that carries the rod 7 moves upwardly along with an upward pivotal movement of a lever 9 that is interlocked with the U action of the L/U mechanism 10.

The tapered surface 21a has a rightwardly descending slope, which forces the coupling pin 8 to slide leftwardly, as the rod 7 integral with the member 6 ascends with the lever 9 rotating CW. The leftwardly slid pin 8 enters a slot of a left coupling rod 5, thus connecting the lower rod member 6 with an upper rod member 4.

As the lever 9 is rotated CW, the upper rod member 4 goes up, causing a bell crank 3 to rotate CCW, pushing a knob rod 2 in its U direction, so that a door lock knob 1

is set to its unlock position.

The door lock system includes a locked/unlocked status detecting means A3 comprising a status detection switch 12 composed of a pair of switch elements (electrodes) 12A, 12B. One switch element 12B had been in contact with the other switch element 12A before departing therefrom to detect a latest locked status of a door D. The lower element 12B then went down with an L action of the lever 9. The upper element 12A, which may be fixed in position or adequately displaced, is thus located vertically off at a distance from the element 12B so that, in the way of a current unlocking, the switch 12 is permitted to output an unlock detection signal at a timing past a connection established by a coupling 5-8-7 between a drive section L that includes the lever 9 and a manually operable section K that includes the door lock knob 1.

One may consider a door lock system Sa comprising: a manually operable section K including members 1 to 5; an electric actuator M including a door lock actuator 16; a super-locking means A2 including pin 8 and a super-lock actuator 17; a locked/unlocked status detecting means A3 including status switch 12; a super-lock cancelling means A5 including member 21; an unlock forcing means A4 including program files; a drive section comprising a combination of members 7-6, 9 and 11 and L/U mechanism 10; and a locking/unlocking means comprising a controller 15 and the electric actuator M.

Moreover, one may consider a locking/unlocking means comprising such the locking/unlocking means, such the drive section, and the manually operable section K.

In the embodiment, however, the L/U mechanism 10 constitutes a locking/unlocking means A1, as described, and the drive section L comprises members 6-7, 9, 11, 18 (and a key cylinder 13 of a concerned door). It will be seen that the electric actuator M may comprise the door lock actuator 16, and an associated subsystem including program files for controlling the actuator 16 in response to an external

operation Oe that may be a manual operation to a remote controller or a key operation to the key cylinder 13 of a different door.

Fig. 6 shows electrical connections of a door lock system controller 15 of the door lock system of Fig. 5.

The system controller 15 comprises a microcomputer, input circuitry for inputting terminal voltages of the status switch 12, the key cylinder switch 14 and an ignition switch 31, and output circuitry for outputting analog control signals to the door lock actuator 16 and a super-lock actuator 17. Designated at reference character +B is a DC power supply line connected via a fuse in a junction box to a voltage supply terminal of a vehicle-mounted battery that has a limited capacity.

The microcomputer comprises an I/O interface including A/D converters connected to the input circuitry and D/A converters connected to the output circuitry, a ROM for storing program files and basic data, a RAM for storing various associated data including interfaced data from the input circuitry and processed data including control data, a CPU for processing input data in accordance with instructions of read program files, and combinational logic, registers, etc.

The output circuitry includes transistor switches turning on and off in accordance with pulse signals output from the microcomputer, solenoids for conducting currents to develop magnetic fields in dependence on actions of the transistor switches, voltage pulse generators operable with the magnetic fields, and two pairs of polarity-defined control pulse lines connected to input terminals of step motors M constituting the actuators 16, 17. Motor torque depends on an average amplitude of a variable number of control pulses in a unit time. Each control pulse has a voltage amplitude in proportion to a supply voltage of the +B line.

It will be seen that the controller 15 may have four combinations of such input and output circuitry in a one to

one corresponding manner to four doors D of the vehicle, as the microcomputer is common.

Fig. 7 is a flow chart covering essential steps to be executed at the CPU for an L/U control of the door D and a super-lock on-off control of the system Sa.

Steps S1 to S10 and a return routine are identical to those of Fig. 2. Steps S21 and S23 correspond to the steps S11 and S12, respectively.

The ignition switch 31 is turned on by a driver in a passenger room. Then, as a super-lock on flag is set to a 1, the program flow has come to the step S21, where an unlock signal is output to the door lock actuator 16 of each door D to drive the L/U mechanism 10 in a U side for unlocking the door D and, concurrently, a super-lock cancel signal is output to the super-lock actuator 17 of each door D to actuate the coupling pin 8 in the leftward direction, thereby to cancel the super-lock on state, thus permitting the door D to be manually unlocked by the door lock knob 1.

Then, the flow goes to a decision step S22 to check if the status switch 12 has detected an unlocked status of the door D, with a detection signal turned on in terms of unlock detection. Unless the unlocked status is detected, the flow again goes to the step S21 to repeat actions for unlocking the door D and cancelling the super-locking.

If the unlocked status is detected by the switch 12 and confirmed by a detection signal therefrom, the flow goes to the step S23 for resetting the flag to a 0, before entering the returning routine.

Therefore, even in a case the door lock actuator 16 and/or the super-lock actuator 17 have occasionally reduced power for actuation due such as to a battery voltage drop when cranking, the actuators 16, 17 are kept controlled continuously or intermittently for rotating the lever 9 CW to unlock the door D and to force the pin 8 into a leftward sliding by the engagement member 21 and for additionally actuating the pin 8 to the left, over a sufficient interval for a battery to supply a recovered +B voltage so that the

actuators 16, 17 have recovered motor torque.

The driver as well as other passengers, if any, can go out of the vehicle without an undue key operation with an arm stretched through an open window. Moreover, the door D can then be voluntarily locked or unlocked by a manual operation to the door lock knob 1.

Even when the super-lock actuator 17 has failed to actuate the coupling pin 8 for super-lock cancellation, the engagement member 21 ensures cancelled super-locking, as the pin 8 (of which the right end is brought into contact with the tapered surface 21a of that member 21) is forced to leftwardly slide with an upward rotation of the lever 9 that is mechanically interlocked with a concurrent unlock action.

The timing for a detection signal of the status switch 12 to change from a lock representative voltage (e.g. a potential difference between a potential at a +B or potentiometer terminal and a grounded potential, see Fig. 6) to an unlock representative voltage (e.g. the grounded potential) depends on a relative distance between the switch elements 12A, 12B, which is set to be sufficient for the pin 8 to slide by a necessary stroke for an ensured super-lock cancellation. Therefore, when an unlocked status is confirmed (at the step S22) by the CPU with an associated detection signal input thereto, the super-lock cancellation has been completed.

This cancellation may substitute for the super-lock cancellation by controlling the super-lock actuator 17, while the latter provides for cancelling a prevailing super-lock to permit the door D to be manually unlocked from inside, when the door lock actuator 16 does not work.

In the embodiment described, the confirmation timing of a detected unlocked status of door D is mechanically set as a distance between switch elements 12A, 12B of the status switch 12. It will however be seen that such a timing may preferably be electrically set or adjusted at the CPU and/or by a temporarily insertable delay circuit in

the output circuitry and/or in the input circuitry, as necessary, to permit fast detection at the status switch 12 and careful final confirmation at the end of system controller 15.

Incidentally, in a sense, the super-lock cancelling means A5 may include the super-lock actuator 17, as it is controlled therefor

Figs. 8 and 9 show another embodiment of the invention covering the sixth aspect Sb. Fig. 8 is a block diagram corresponding to Fig. 5, and Fig. 9, a flow chart corresponding to Fig. 7.

In a door lock system Sb shown in Fig. 8, members or parts 1 to 17 are identical to those of Fig. 5, unless otherwise described herein.

The door lock system of Fig. 8 includes a connected/disconnected status detecting means B3 comprising a detection switch 41 composed of a pair of switch elements (electrodes) 41A, 41B disposed: one 41A at a left end of a coupling pin 8; and the other 41B in position to contact with the former 41A when the pin 8 is inserted in a slot of a left coupling rod 5 by a sufficient stroke for a complete coupling to ensure cancelled super-locking at a concerned door D.

The detection switch 41 provides a detection signal representative of a connection between a drive section L and a manually operable section K or of a disconnection therebetween, which signal is input to a door lock system controller 15.

The door lock system of Fig. 8 further includes a super-lock cancellation forcing means B4 comprising program files and hence cooperative with a combination of a locked/unlocked status detecting means A3 and an unlock forcing means A4 of the first aspect (see Figs. 3, 4). In a sense, the super-lock cancellation forcing means B4 may further comprise an ignition switch, and a super-lock actuator 17.

Fig. 9 is a flow chart covering essential steps to be

executed at a CPU for an L/U control of the door D and a super-lock on-off control of the system Sb.

Steps S1 to S10 and a return routine are identical to those of Fig. 2. Steps S31 and S33 correspond to the steps S11 and S12, respectively.

An ignition switch is turned on by a driver in a passenger room. Then, as a super-lock on flag is set to a 1, the program flow has come to the step S31, where a super-lock cancel signal is output to a super-lock actuator 17 of each door D to actuate the coupling pin 8 in the leftward direction, thereby to cancel the super-lock on state, thus permitting the door D to be manually unlocked by a door lock knob 1.

Then, the flow goes to a decision step S32 to check if the detection switch 41 has detected a cancelled super-locking at each door D, with the coupling pin 8 leftwardly actuated by the super-lock actuator 17. Unless that is detected, the flow again goes to the step S31 to repeat actions for cancelling the super-locking.

If the concerned detection is confirmed by a detection signal from the switch 41, the flow goes to the step S33 for resetting the flag to a 0, before entering the returning routine.

In this embodiment, the super-lock actuator 17 is kept controlled for cancelling super-locking, until the CPU confirms cancelled super-locking Therefore, the driver as well as other passengers, if any, can go out without an undue key operation with an arm stretched through an open window. Moreover, the door D can be voluntarily locked or unlocked by a manual operation to a door lock knob 1.

While preferred embodiments of the present invention have been described using specific terms, such description is for illustrative purposes, and it is to be understood that changes and variations may be made without departing from the scope of the following claims.

CLAIMS:

1. A door lock system (Sa) for a vehicle having an engine (E) and a passenger room provided with a door (D), the door lock system including:

a manually operable section (K; 1, 2, 3, 4, 5) for transmitting an internal operation (Oi) manually exercised inside the passenger room;

a drive section (K; 6, 7, 9, 11, 18) connectable to and disconnectable from the manually operable section;

an electric actuator (M; 13, 14, 15, 16) controllable for actuating the drive section in accordance with an external operation (Oe) exercised outside the vehicle;

a first means (A1; 10) drivable by the drive section for locking and unlocking the door in accordance with one of the internal operation, as the drive section is connected to the manually operable section, and the external operation, as the drive section is actuated by the electric actuator; and

a second means (A2; 8, 17) controllable for disconnecting the drive section from the manually operable section to render the internal operation ineffective,

wherein the door lock system further includes:

a third means (A3; 12, 15) for detecting to confirm a locked status of the door and an unlocked status of the door; and

a fourth means (A4; S21, S22) operable along with a startup operation of the engine, as the locked status is confirmed by the third means, for controlling the electric actuator so that the first means is driven to unlock the door until the locked status is confirmed by the third means.

2. A door lock system (Sa) according to claim 1, wherein:

the fourth means (A4; S21, S22) is operable along with said controlling the electric actuator, until the unlocked status is confirmed by the third means, for cancelling a

super-locking action of the second means to connect the drive section with the manually operable section so that the first means is drivable in accordance with the internal operation.

3. A door lock system (Sa) according to claim 1 or 2, further including:

a fifth means (A5; 21) mechanically interlocked with an unlocking action of the first means, for connecting the drive section with the manually operable section.

4. A door lock system (Sa) according to claim 3, wherein:

the third means (A3; 12, 15) confirms the unlocked status, as it is detected after a confirmation of the locked status, by having a signal output at a timing past a connection between the drive section and the manually operable section.

5. A door lock system (Sa) according to any of claims 1 to 4, wherein the second means (A2; 8, 17) includes an electric actuator (M'; 17) controllable for cancelling a connected state of the drive section with the manually operable section to render the manual operation ineffective.

6. A door lock system (Sb) for a vehicle having an engine (E) and a passenger room provided with a door (D), the door lock system including:

a manually operable section (K; 1, 2, 3, 4, 5) for transmitting an internal operation (Oi) manually exercised inside the passenger room;

a drive section (L; 6, 7, 9, 11, 18) connectable to and disconnectable from the manually operable section;

an electric actuator (M; 13, 14, 15, 16) controllable for actuating the drive section in accordance with an external operation (Oe) exercised outside the vehicle;

a first means (A1; 10) drivable by the drive section for locking and unlocking the door in accordance with one of the internal operation, as the drive section is connected to the manually operable section, and the external operation, as the drive section is actuated by the electric actuator; and

a second means (A2; 8, 17) controllable for disconnecting the drive section from the manually operable section to effect a super-locking for rendering the internal operation ineffective,

wherein the door lock system further includes:

a third means (B3; 41, 15) for detecting a connected status and a disconnected status of the drive section relative to the manually operable section; and

a fourth means (B4; S31, S32) operable along with a startup operation of the engine, as the disconnected status is detected by the third means, for cancelling the super-locking until the connected status is detected by the third means.

7. A door lock system substantially as described with reference to Figures 5 to 7 or Figures 8 and 9 of the accompanying drawings.

The Patent Office

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Application No:	GB 9711275.9	**Examiner:**	P J Silvie
Claims searched:	1-6	**Date of search:**	24 July 1997

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Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): E2A (AARN, ABJ, ABX, AMXF)

Int Cl (Ed.6): E05B (65/20, 65/36, 65/42)

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2 277 352 A (NISSAN) see fig.9	1
A	EP 0 062 851 A1 (NISSAN) see whole document	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.